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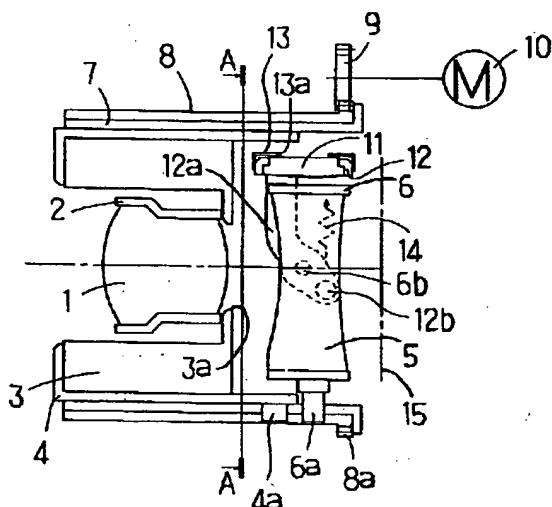
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(54) 【発明の名称】 レンズ鏡筒

(57) 【要約】

【目的】 少なくとも1群、2群の2つのレンズ群2、5からなるズーム撮影光学系と、撮影光軸上の位置と該撮影光軸上を退避した位置とに切替可能なインナーコンバーターレンズ11とを有するレンズ鏡筒において、ズーム光学系のみの場合の鏡筒の大きさからほど大きくすることなく、通常のズームによる可変焦点距離領域に加えてワンポイントの焦点距離を設定可能としたこと。

【構成】 前記2群レンズ5の有効径外にDカット5aを形成し、前記インナーコンバーターレンズを撮影光軸上の位置と、前記Dカット5aによりできた空間19内の退避位置とに切替可能に、前記インナーコンバーターレンズ11のホルダー12を前記2群レンズ5のホルダ-6に撮影光軸と直角方向に回動可能に保持させたこと。



ている。この直進ガイド筒7には撮影光軸に平行な溝7a, 7bがそれぞれ3ヶ、7cが2ヶ設けられており、溝7aには鏡筒枠4の3ヶのピン4aが嵌合し、溝7bには2群ホルダー6の3ヶのピン6aが、溝7cにはインナーコンバーターレンズ11のホルダー12の2ヶのピン12bが嵌合し、それぞれ撮影光軸方向に直進するようにガイドされている。

【0015】カム筒8にはカム溝8b, 8cがそれぞれ3ヶ設けられており、カム溝8bには鏡筒枠4のピン4aが嵌合し、カム溝8cには2群ホルダー6のピン6aが嵌合している。したがって、カム筒8が回動すると、鏡筒枠4はカム溝8bに駆動され、2群ホルダー6はカム溝8cに駆動され、それぞれ撮影光軸方向に所定量直進することになる。

【0016】上記インナーコンバーターレンズ11のホルダー12の腕12aの先端のピン12bはカム筒8にまで達していないため、カム筒8とは干渉しない。このカム筒8の外周にはギア部8aが設けられており、ギア9と噛み合っている。このギア9はモータ10と減速ギア列を介して連結しており、カム筒8はモータ10によって回動する。モータ10によるズームレンズの制御については公知であるためここでは説明を省略する。

【0017】次に上記実施例の動作について説明をする。図1は1群レンズ1、及び2群レンズ5が最もフィルム面15側に繰り込まれた沈胴状態であり、鏡筒枠4のピン4aと2群ホルダー6のピン6aは、図7において、それぞれの位置4b, 6cに保持されている。

【0018】この沈胴状態においては、2群ホルダー6が最も繰り込まれるため、2群ホルダー6に保持されるインナーコンバーターレンズ11も最も繰り込まれることになり、ホルダー12の腕12aの先端のピン12bは図7において位置12cにきており、溝7cの斜面によって、パネ13の力に抗して回動させられ、インナーコンバーターレンズ11は2群レンズ5をDカット5aした空間19へ退避している。

【0019】図1の沈胴状態からモータ10によってカム筒8が回動させられると、カム溝8b, 8cに従って鏡筒枠4のピン4aと2群ホルダー6のピン6aはそれぞれ繰り出され、図7の実線位置4a, 6aに停止する。インナーコンバーターレンズ11のホルダー12の腕12aの先端のピン12bも2群ホルダー6とともに繰り出されることとなり、溝7cに従って図7の実線位置12bにくる。インナーコンバーターレンズ11のホルダー12はパネ14によって付勢されており、図示しないストップバーに当接して位置決めされている。この図示ないストップバーは2群ホルダー6に設けててもよいし、シャッターユニット3に設けててもよい。

【0020】この時インナーコンバーターレンズ11の光軸と、1群レンズ1および2群レンズ5によって構成される光学系の撮影光軸とが一致しており、広角撮影光

学系を構成している。

【0021】この広角撮影光学系では、シャッターユニット3のシャッターが全開になった時の開放の絞りを決定するのは、固定絞り13のエッジ13aであり、シャッターユニット3のエッジ3aよりも径が小さく、インナーコンバーターレンズ11が撮影光路上にあるときと退避したときとで開放絞り径の切替を可能にしている。

【0022】この広角撮影状態からモータ10によってカム筒8をさらに回動させると、1群レンズ1、2群レンズ5はカム溝8b, 8cに従って更に繰り出され、鏡筒枠4のピン4a、2群ホルダー6のピン6aは図7において位置4c, 6dにくる。インナーコンバーターレンズ11のホルダー12の腕12aの先端のピン12bは2群レンズ5とともに繰り出されるため、溝7cの斜面に沿って変位させられ、インナーコンバーターレンズ11のホルダー12はパネ14に抗して再び退避方向に回動し、図3の状態になる。この状態では1群レンズ1と2群レンズ5によって撮影光学系が構成され、中焦点距離撮影系となっている。

【0023】モータ10によって、さらにカム筒8を回動させると、鏡筒枠4のピン4aと2群ホルダー6のピン6aはさらに繰り出され、図7において、それぞれ位置4d, 6eにくる。インナーコンバーターレンズ11のホルダー12の腕12aの先端のピン12bは位置12eとなり、図3と同様、インナーコンバーターレンズ11が撮影光路から退避した位置に保持されて図4の状態になる。この状態では、最も繰り出された1群レンズ1と2群レンズ5によって撮影光学系が構成され、長焦点距離撮影光学系となっている。

【0024】図3の中焦点距離撮影系と図4の長焦点距離撮影系との間はズーミング動作によって任意の焦点距離に停止可能であるが、より短焦点側は図2の広角撮影状態1点のみ停止可能となっている。例えば、焦点距離3.5mから7.0mmの連続ズームに加えて、ワンポイントの焦点距離2.8mmの撮影光学系となるわけであるが、焦点距離3.5m~7.0mmのズーム撮影系からほとんど鏡筒の大きさを変えることなく、焦点距離2.8mmを加えることが可能となっている。

【0025】

【発明の効果】以上説明したように請求項1記載の発明によれば、少なくとも1群、2群の2つのレンズ群からなるズーム撮影光学系の該2群レンズの有効径外にDカットを形成するとともに、この2群レンズのホルダーに撮影光軸と直角方向の軸回りに回動可能にインナーコンバーターレンズのホルダーを保持させ、このインナーコンバーターを撮影光軸上の位置と上記Dカットでできた空間の退避位置とに切替可能に構成したので、ズーム光学系のみの場合の鏡筒の大きさからほとんど大きくすることなく、通常のズームによる可変焦点距離領域に加えてワンポイントの焦点距離を設定することが可能となつ

た。

【0026】また、請求項2記載の発明によれば、インナーコンバーターレンズに固定絞りを固着したので、複雑な機構を用いることなく、インナーコンバーターレンズの使用時と非使用時とで開放絞り径を切替えることが可能であるという効果が得られる。

【図面の簡単な説明】

【図1】 本発明を実施したレンズ鏡筒のレンズ収納状態を示す簡略断面図

【図2】 そのレンズ鏡筒の広角撮影状態を示す簡略断面図

【図3】 そのレンズ鏡筒の中焦点状態を示す簡略断面図

【図4】 そのレンズ鏡筒の長焦点状態を示す簡略断面

図

【図5】 図1のA-A線に沿う横断面図

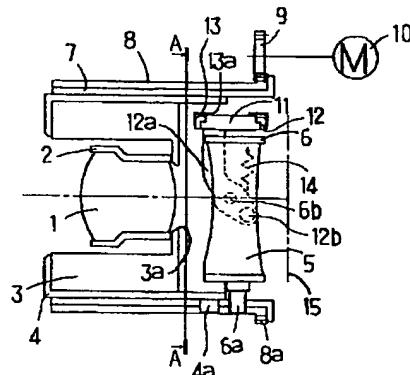
【図6】 図2のB-B線に沿う横断面図

【図7】 ズームの直進ガイド筒の内面展開図

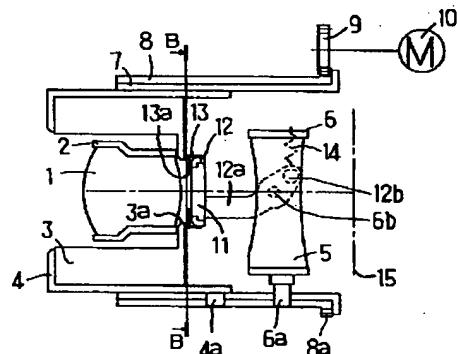
【符号の説明】

1	1群レンズ
2	1群ホルダー
5	2群レンズ
5a	Dカット
6	2群ホルダー
11	インナーコンバーターレンズ
12	ホルダー
13	固定絞り
19	空間

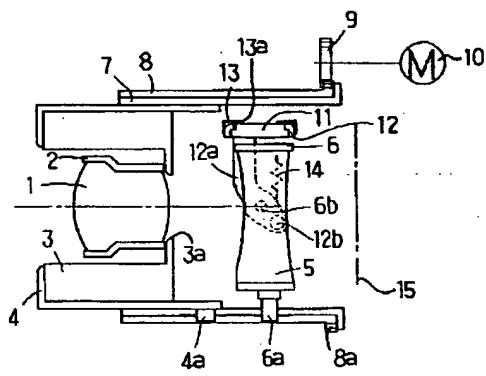
【図1】



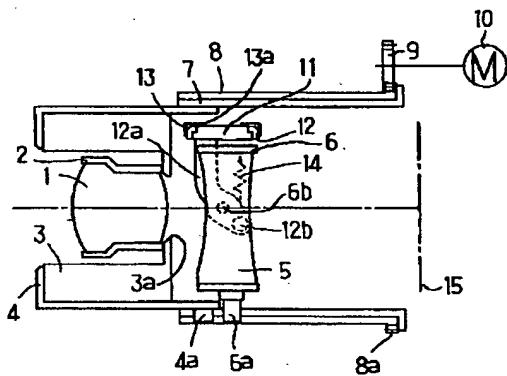
【図2】



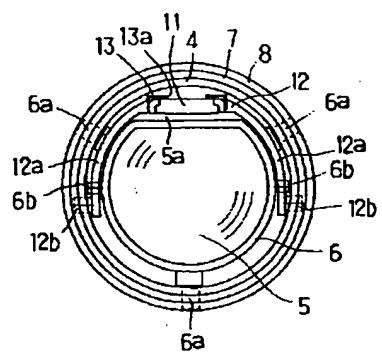
【図3】



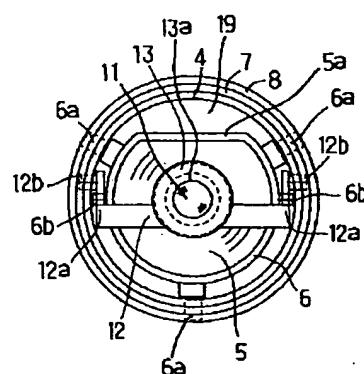
【図4】



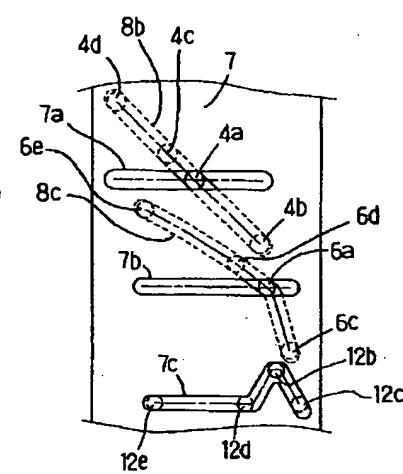
【四】



〔四六〕



[図7]



Date: April 8, 2005

Declaration

I, Michihiko Matsuba, President of Fukuyama Sangyo Honyaku Center, Ltd., of 16-3, 2-chome, Nogami-cho, Fukuyama, Japan, do solemnly and sincerely declare that I understand well both the Japanese and English languages and that the attached document in English is a full and faithful translation of the copy of Japanese Unexamined Patent Publication No. Hei-7-199019 laid open on August 4, 1995.



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LENS BARREL

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Filed on: January 10, 1994

Inventor: Takanori KOHIRA

Applicant: Canon Corporation

Patent Attorney: Yukio TAKANASHI

SPECIFICATION

[TITLE OF THE INVENTION] LENS BARREL

[ABSTRACT]

[Object] In a lens barrel having a zooming photographic optical system including at least two first and second lens groups 1 and 5 and an inner converter lens 11 which can switch between a position on a photographing optical axis and a position retracted from the photographing optical axis, to make it possible to set the one point focal length as well as the variable focal range of normal zooming without an increase in size of the barrel from the size of the lens barrel that is provided with only the zooming optical system.

[Construction] A D cut 5a is formed out of the effective

diameter of the second group lens 5, and the inner converter lens is held so as to switch between a position on the photographing optical axis and a retracted position inside a space 19 created by the D cut 5a, and the holder 12 of the inner converter lens 11 is held on the holder 6 of the second group lens 5 so as to rotate perpendicularly to the photographing optical axis.

WHAT IS CLAIMED IS;

[Claim 1] A lens barrel having a zooming photographic optical system including at least two lens groups of first and second groups and an inner converter lens that can switch between a position on a photographing optical axis and a position retracted from the photographing optical axis, wherein a D cut is formed out of the effective diameter of the second group lens, and the inner converter lens is held so as to switch between the position on the photographing optical axis and a retracted position inside a space created by the D cut, and the holder of the inner converter lens is held on the holder of the second group lens so as to rotate perpendicularly to the photographing optical axis.

[Claim 2] The lens barrel according to Claim 1, wherein a fixed stop that determines an aperture stop when using the inner

converter lens is fixed to the inner converter lens.

DETAILED DESCRIPTION OF THE INVENTION

[Field of the Invention]

[0001]

[Field of the Invention] The invention relates to a zoom lens that varies its focal length, more specifically, a lens barrel which holds a zoom lens in which an inner converter lens is inserted on the photographing optical axis when the focal length is short.

[0002]

[Prior Art] A conventional lens barrel belonging to this type is constructed as described in the Specification of US Patent No. 5166716 so that an inner converter lens is normally retracted to the outside of the lens barrel, and the inner converter lens slides orthogonally to the photographing optical axis and enters the inside of the lens barrel when the zoom lens inside the lens barrel comes to a predetermined position.

[0003] In addition, the inner converter lens is supported inside the lens barrel so as to rotate around an axis in parallel to the photographing optical axis, and is held at a position retracted from the photographing optical path in a normal condition, and is rotated around the axis and inserted into

the photographing optical path in the case of a wide angle.

[0004]

[Problems to be Solved by the Invention] However, among the conventional examples, according to the Specification of US patent No. 5166716, a space for retracting the inner converter lens is required, resulting in an increase in the size of the camera.

[0005] In addition, in the conventional example in which the inner converter lens moves in parallel to the direction orthogonal to the photographing optical axis to retract from the photographing optical path, the diameter of the lens barrel frame holding the zoom lens must include the retracting space of the inner converter lens, resulting in an increase in diameter of the lens barrel frame.

[0006] An object of the invention is to obtain a lens barrel which solves the above-described problems.

[0007]

[Means for Solving Problems] According to Claim 1 of the invention, in a lens barrel having a zooming photographic optical system including at least two lens groups of first and second groups and an inner converter lens that can switch between a position on a photographing optical axis and a position retracted from the photographing optical axis, a D

cut is formed out of the effective diameter of the second group lens, and the inner converter lens is held so as to switch between the position on the photographing optical axis and the retracted position inside a space created by the D cut, and the holder of the inner converter lens is held on the holder of the second group lens so as to rotate perpendicularly to the photographing optical axis, whereby it becomes possible to arrange the inner converter lens inside the lens barrel without increasing the lens barrel diameter.

[0008] According to Claim 2 of the invention, when using the inner converter lens, a fixed stop that determines an aperture stop is fixed to this inner converter lens, whereby the diameter of the aperture stop can be switched between the case of using the inner converter lens and the case where the inner converter lens is not used.

[0009]

[Embodiment] Fig. 1 through Fig. 4 show an embodiment of the invention, wherein Fig. 1 is a longitudinal sectional view of a lens housed state, Fig. 2 is a longitudinal sectional view in the state with a short focal length, Fig. 3 is a longitudinal sectional view in the state with a middle focal length, and Fig. 4 is a longitudinal sectional view in the state with a long focal length. Fig. 5 is a cross sectional view along the

A-A line of Fig. 1, Fig. 6 is a cross sectional view along the B-B line of Fig. 2, and Fig. 7 is a developed view of a rectilinear guide cylinder of a zoom lens viewed from the inside.

[0010] In the figures, the first group lens 1 is held by the holder 2, and this first group holder 2 is held on the shutter unit 3. The shutter unit 3 has an edge 3a that determines the aperture stop, and is fixed to the lens barrel frame 4. On the outer circumference of this lens barrel frame 4, pins are provided on three points.

[0011] The second group lens 5 is held by the second group holder 6, and on the outer circumference of this second group holder 6, pins 6a are provided at three points. The second group holder 6 is provided with shafts 6b orthogonal to the photographing optical axis at two points. The inner converter lens 11 is held by the holder 12, and the front ends of the arms 12a of this holder 12 fit the shafts 6b of the second group holder 6, and to the front face of the holder 12, a fixed stop 13 having an edge 13a is fixed.

[0012] The holder 12 is held so as to rotate almost 90° around the shafts 6b that are perpendicular to the photographing optical axis, and the inner converter lens 11 can move to a position on the photographing optical axis and a position

retracted from the photographing optical axis.

[0013] A part of the second group lens 5 out of the effective diameter that photographic light passes through is cut by the D cut 5a as shown in Fig. 5 and Fig. 6, and the inner converter lens 11 retracts to the space 19 created by this D cut 5a. To the front ends of the arms 12a of the holder 12, pins 12b are fixed, and near the pins, springs 14 are laid and pressed so as to position the inner converter lens 11 on the photographing optical axis.

[0014] The rectilinear guide cylinder 7 is fixed to a camera main body that is not shown, and on the outer circumference thereof, a cam tube 8 fits rotatably. This rectilinear guide cylinder 7 is provided with three each of grooves 7a and 7b by three each and two each of grooves 7c by two each in parallel to the photographing optical axis, and the three pins 4a of the lens barrel frame 4 fit the grooves 7a, the three pins 6a of the second group holder 6 fit the grooves 7b, and the two pins 12b of the holder 12 of the inner converter lens 11 fit the grooves 7c, and these are guided so as to go straight in the photographing optical axis direction.

[0015] The cam tube 8 is provided with three each of cam grooves 8b and 8c, and the pins 4a of the lens barrel frame 4 fit the cam grooves 8b, and the pins 6a of the second group holder 6

fit the cam grooves 8c. Therefore, when the cam tube 8 rotates, the lens barrel frame 4 is driven by the cam grooves 8b and the second holder 6 is driven by the cam grooves 8c to go straight by predetermined distances in the photographing optical axis direction, respectively.

[0016] The pins 12b on the front ends of the arms 12a of the holder 12 of the inner converter lens 11 have not yet reached the cam tube 8, so that they do not interfere with the cam tube 8. On the outer circumference of this cam tube 8, a gear part 8a is provided and engaged with a gear 9. This gear 9 is joined to a motor 10 via a reduction gear row, and the cam tube 8 is rotated by the motor 10. Control of the zoom lens by the motor 10 is generally known, so that description thereof is omitted herein.

[0017] Next, operations of the above-described embodiment are explained. Fig. 1 shows a barrel retracted state in that the first group lens 1 and the second group lens 5 are retracted to the side closest to the film surface 15, and the pins 4a of the lens barrel frame 4 and the pins 6a of the second group holder 6 are held at the positions 4b and 6c in Fig. 7, respectively.

[0018] In this barrel retracted state, the second group holder 6 is retracted the most, so that the inner converter lens 11

held by the second group holder 6 is also retracted the most, and the pins 12b on the front ends of the arms 12a of the holder 12 reach the position 12c in Fig. 7 and rotate against the force of the springs 13 by the slope of the grooves 7c, and the inner converter lens 11 is retracted to the space 19 formed by cutting the second group lens 5 by the D cut 5a.

[0019] From this barrel retracted state of Fig. 1, when the cam tube 8 is rotated by the motor 10, the pins 4a of the lens barrel frame 4 and the pins 6a of the second group holder 6 are protruded according to the cam grooves 8b and 8c and stopped at the solid-line positions 4a and 6a of Fig. 7. The pins 12b on the front ends of the arms 12a of the holder 12 of the inner converter lens 11 are also protruded together with the second group holder 6, and reach the solid-line position 12b of Fig. 7 according to the grooves 7c. The holder 12 of the inner converter lens 11 is pressed by the springs 14 and positioned in contact with a stopper that is not shown. This unillustrated stopper may be provided on the second group holder 6 or the shutter unit 3.

[0020] At this point, the optical axis of the inner converter lens 11 and the photographing optical axis of the optical system formed by the first group lens 1 and the second group lens 5 match each other, whereby a wide-angle photographic optical

system is formed.

[0021] In this wide-angle photographic optical system, the aperture stop when the shutter of the shutter unit 3 is fully opened is determined by the edge 13a of the fixed stop 13, and the diameter thereof is smaller than the edge 3a of the shutter unit 3 so that the aperture stop diameter can be switched between in the case where the inner converter lens 11 is on the photographing optical path and the case where the inner converter lens is retracted.

[0022] When the cam tube 8 is further rotated by the motor 10 from this wide-angle photographing state, the first group lens 1 and the second group lens 5 are further protruded according to the cam grooves 8b and 8c, and the pins 4a of the lens barrel frame 4 and the pins 6a of the second group holder 6 come to the positions 4c and 6d of Fig. 7. Since the pins 12b on the front ends of the arms 12a of the holder 12 of the inner converter lens 11 are protruded together with the second group lens 5, so that they are displaced along the slope of the grooves 7c, and the holder 12 of the inner converter lens 11 rotates again to retract against the springs 14 and reaches the state of Fig. 3. In this state, the photographic optical system is formed into a middle focal length photographic system by the first group lens 1 and the second group lens 5.

[0023] When the cam tube 8 is further rotated by the motor 10, the pins 4a of the lens barrel frame 4 and the pins 6a of the second group holder 6 are further protruded and reach the positions 4d and 6e of Fig. 7, respectively. The pins 12b on the front ends of the arms 12a of the holder 12 of the inner converter lens 11 come to the position 12e, and as in Fig. 3, the inner converter lens 11 is held at the position retracted from the photographing optical path and reaches the state of Fig. 4. In this state, the photographic optical system is formed into a long focal length photographic optical system by the first group lens 1 and the second group lens 5 that have been protruded the most.

[0024] Between the middle focal length photographic system of Fig. 3 and the long focal length photographic system of Fig. 4, the lens barrel can stop at an arbitrary position by zooming operation, however, at a shorter focal point side, the lens barrel can stop only at one point of the wide-angle photographing state of Fig. 2. For example, in addition to continuous zooming from the focal length of 35mm to 70mm, the photographic optical system with a one-point focal length of 28mm is formed, so that it becomes possible to add the focal length of 28mm without increasing the lens barrel from the size of the zooming photographic system with the focal length of

35m to 70mm.

[0025]

[Effects of the Invention] As described above, according to Claim 1 of the invention, in a zooming photographic optical system including at least two lens groups of first and second groups, a D cut is formed out of the effective diameter of the second group lens, and this second group lens holder is made to hold the holder of the inner converter lens in a rotatable manner around an axis perpendicular to the photographic optical axis, the inner converter lens is held so as to switch between the position on the photographing optical axis and a retracted position inside a space created by the D cut, so that a one-point focal length can be set in addition to the variable focal length region of normal zooming without increasing the size of the lens barrel from the size of the lens barrel provided with only the zooming optical system.

[0026] In addition, according to Claim 2 of the invention, since the fixed stop is fixed to the inner converter lens, the aperture stop diameter can be switched between the case using the inner converter lens and in the case where the inner converter lens is not used without using a complicated mechanism.

[BRIEF DESCRIPTION OF THE DRAWINGS]

[Fig. 1] is a schematic sectional view showing a lens housed state of the lens barrel in which the invention is carried out.

[Fig. 2] is a schematic sectional view showing a wide-angle photographing state of the same lens barrel.

[Fig. 3] is a schematic sectional view showing a middle focal length state of the same lens barrel.

[Fig. 4] is a schematic sectional view showing a long focal length state of the same lens barrel.

[Fig. 5] is a cross sectional view along the A-A line of Fig. 1.

[Fig. 6] is a cross sectional view along the B-B line of Fig. 2.

[Fig. 7] is an inner surface developed view of the rectilinear guide cylinder for zooming.

[Description of symbols]

1 first group lens

2 first group holder

5 second group lens

5a D cut

6 second group holder

11 inner converter lens

12 holder

13 fixed stop

19 space

Fig.1

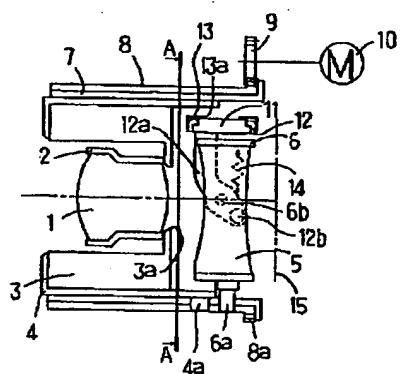


Fig.2

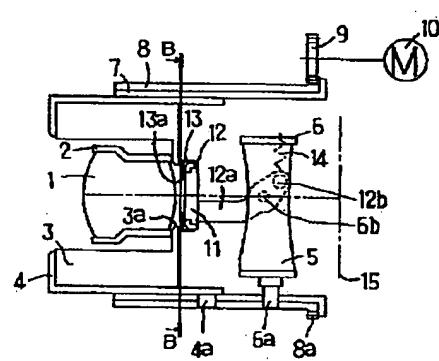


Fig.3

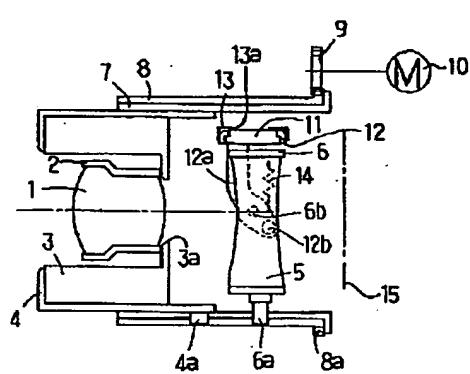


Fig.4

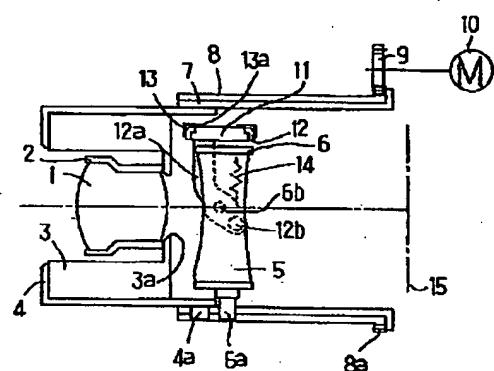


Fig.5

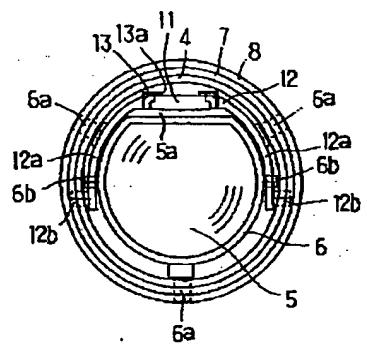


Fig.6

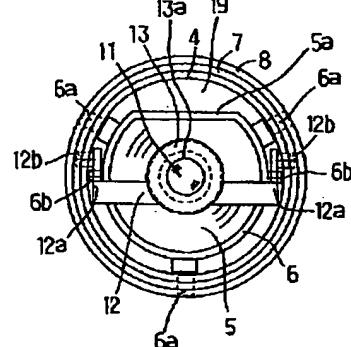


Fig.7

